REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1, 4, 5, 7, 9, 10, 12, 15, 16, 18, 20, and 21 are pending in this application. Claims 6, 11, 17, and 22 are canceled without prejudice or disclaimer and Claims 1, 7, 12, and 18 are amended. Amended Claims 1, 7, 12, and 18 are supported by the original claims, and therefore add no new matter.

In the outstanding Official Action, Claims 1, 4-7, 9-12, 15-18, and 20-22 were rejected under 35 U.S.C §112, first paragraph; and Claims 1, 4-7, 9-12, 15-18, and 20-22 were rejected under 35 U.S.C. §103(a) as unpatentable over Applicant's Prior Art (Fig. 7) in view of Yano (U.S. Patent No. 6,118,165 hereafter Yano).

With regard to the rejection of Claims 1, 4-7, 9-12, 15-18, and 20-22 under 35 U.S.C §112, first paragraph, it is respectfully submitted that the subject matter asserted by the outstanding Office Action as new matter[1] is supported at least by the specification at page 10, lines 1-6. Accordingly, it is respectfully submitted that Claims 1, 4, 5, 7, 9, 10, 12, 15, 16, 18, 20, and 21 are in compliance with all requirements under 35 U.S.C. §112, first paragraph.

With regard to the rejection of Claim 1 as unpatentable over Applicant's Prior Art (Fig. 7) in view of Yano, that rejection is respectfully traversed.

Amended Claim 1 recites a semiconductor light-receiving device comprising:

> a semiconductor substrate having a first surface on a light-receiving side and a second surface on the opposite side to said first surface, said semiconductor substrate comprising a first conductivity type;
> a semiconductor layer formed on said first surface of said semiconductor substrate;
> a plurality of first semiconductor regions formed in said semiconductor layer so as to reach said semiconductor substrate from a surface of said semiconductor layer, said

[1]See the outstanding Office Action at page 2, lines 14-18.

plurality of first semiconductor regions being formed apart from each other, and comprising the first conductivity type;

a second semiconductor region selectively formed in a surface region of said semiconductor layer, said second semiconductor region having a lattice form or a network form to surround each of said plurality of first semiconductor regions with surface portions of said semiconductor layer therebetween and comprising a second conductivity type;

a first electrode formed on said second semiconductor region and having a lattice form or a network form;

a second electrode formed on said second surface of said semiconductor substrate;

said surface portions of said semiconductor layer between each of said plurality of first semiconductor regions and said second semiconductor region having higher resistances than resistances of said plurality of first semiconductor regions and said second semiconductor region;

depletion regions predominantly in directions along the surface of said semiconductor layer between said second semiconductor region and each of said plurality of first semiconductor regions configured to deplete said surface portions of said semiconductor layer completely in a state in which a reverse bias is applied between said first electrode and said second electrode,

wherein said surface portions of said semiconductor layer receive incident light predominantly in the surface of said semiconductor layer.

According to the invention recited in Claim 1, <u>light is predominantly incident on the area between each of the plurality of first semiconductor regions and the second semiconductor region without passing through these semiconductor regions. Therefore it is possible to use the light incident on the semiconductor light-receiving device effectively without absorption of the incident light in the semiconductor regions</u>. Further, the areas between the first and second semiconductor regions have higher resistances than resistances of the first and second semiconductor regions. Depletion regions are predominantly spread in directions along the surface of the semiconductor layer between the second semiconductor region and each of the plurality of first semiconductor regions to deplete the area between each of the plurality of first semiconductor regions and the second semiconductor region

completely in a state in which a reverse bias is applied between the first and second electrode so that the sensitivity characteristics of the device can be made superior.

In addition, according to the invention recited in Claim 1, the plurality of first semiconductor regions are formed apart from each other, and the second electrode are formed on the second surface of the semiconductor substrate and <u>not formed on the first semiconductor regions</u>. Therefore, an area for contacting the second electrode is not necessarily on each of the plurality of first semiconductor regions, so that it is possible to <u>narrow a top surface area of the plurality of first semiconductor regions</u>. This results in <u>widening an area between each of the plurality of first semiconductor regions and the second semiconductor region</u>, which is a light-receiving surface, as recited in Claim 1, to increase the amount of light incident on the semiconductor light-receiving device.

Further, according to the invention recited in Claims 7, 12, and 18, it is also possible to gain the above-mentioned effects.

The outstanding Office Action asserted that the Applicant's Prior Art (Fig. 7) discloses the invention recited in Claim 1 except for the second electrode formed on the second side, and <u>Yano</u> discloses a light-receiving device containing a photodiode wherein one electrode is formed on the second side.

However, in the semiconductor light-receiving device of the Applicant's Prior Art (Fig. 7), <u>an N-type epitaxial layer 74 is disposed under plural N-type diffusion regions 76, and regions between the plural N-type diffusion regions 76 and a P-type separating diffusion region 75 are very narrow. In the semiconductor light-receiving device of Fig. 7, light is mainly incident into the N-type epitaxial layer 74 through the plural N-type diffusion regions 76. This decreases the amount of incident light which passes through these regions to the N-type epitaxial layer 74. A large amount of incident light is absorbed in the plural N-type diffusion regions 76 and the P-type separating diffusion region 75</u>. Therefore it is impossible

to use the light incident on the semiconductor light-receiving device effectively, so that a sufficient sensitivity cannot be obtained with this structure. Accordingly, Applicant's Prior Art does not teach or suggest "said surface portions of said semiconductor layer receive incident light predominantly in the surface of said semiconductor layer" as recited in Claim 1.

Further, an electrode for giving a substrate potential 83 is provided on the P-type separating diffusion region 75 and not on the other side of the P-type semiconductor substrate 81. Therefore a large area for contact to the electrode 83 is necessary on the P-type separating diffusion region 75 considering a shift margin of forming the electrode 83, so that it is impossible to narrow a top surface area of the P-type separating diffusion region 75. This results in narrowing an area of the N-type epitaxial layer 74 between the P-type separating diffusion region 75 and each of the plural N-type diffusion regions 76 to decrease amount of light incident to the semiconductor light-receiving device.

Finally, in the semiconductor light-receiving device of the Applicant's Prior Art (Fig. 7 which is a cross-sectional view of the attached Fig. A along a line A-A'.), which is corresponding to Japanese Patent Laid-Open No. 270744/1998, a P-type separating diffusion region 75 is disposed such that the region 75 electrically separates an N-type epitaxial layer 74 into plural light detecting regions Dl, D2, D3, and D5. Each of the plural light detecting regions Dl, D2, D3, and D5 correspond to a photodiode. The region 75 surrounds each of the plural different light detecting regions Dl, D2, D3, and D5. Each of plural N-type diffusion regions 76 is formed apart from each other and disposed corresponding to each of the regions Dl, D2, D3, and D5. In other words, <u>each of the plural N-type diffusion regions 76 is surrounded by the P-type separating diffusion region 75</u>. <u>The configuration of the P-type separating diffusion region 75 and the plural N-type diffusion regions 76 is ***reverse*** to those of the plurality of first semiconductor regions and the second semiconductor region in the invention recited in Claim 1</u>. In the invention recited in Claim 1, the second semiconductor

region has a lattice form or a network form to surround each of the plurality of first semiconductor regions with surface portions of the semiconductor layer therebetween, and further the first electrode has a lattice form or a network form. These features of the invention recited in Claim 1 are not disclosed in the Applicant's Prior Art (Fig. 7). Accordingly, Applicant's Prior Art also does not teach or suggest "a first semiconductor region" or "a second semiconductor region" as defined in Claim 1.

Yano also does not teach or suggest the above-mentioned features of the invention recited in Claim 1, and thus cannot obtain the advantages of the invention recited in Claim 1.

Accordingly, as the cited art does not teach or suggest each and every element of amended Claim 1, it is respectfully submitted that Claim 1 (and Claims 4 and 5 dependent therefrom) is patentable over the cited art.

Amended independent Claims 7, 12, and 18 recite similar elements to amended Claim 1. It is respectfully submitted that Claims 7, 12, and 18 (and Claims 9, 10, 15, 16, 20, and 21 dependent therefrom) are also patentable over the cited art for at least the reasons discussed above with respect to Claim 1.

Accordingly, the outstanding rejection is traversed and the pending claims are believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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